RESEARCH, DEVELOPMENT and TECHNOLOGY TRANSFER
QUARTERLY PROGRESS REPORT (QPR)

Wisconsin Department of Transportation (WisDOT)
DT1241 5/2014

INSTRUCTIONS:
Research principal investigators and/or project managers should complete a quarterly progress report (QPR) for each calendar quarter during which the projects are active.

WisDOT Research Program Category	**Report Period** *(enter year and check which quarter)*
☐ Policy Research	Year: 2014
☒ Wisconsin Highway Research Program	☐ Quarter 1 (Jan 1 – Mar 31) ☐ Quarter 3 (Jul 1 – Sep 30)
☐ Other: _____	☐ Quarter 2 (Apr 1 – Jun 30) ☒ Quarter 4 (Oct 1 – Dec 31)

Project Title	WisDOT Project ID
Critical Factors Affecting Asphalt Concrete Durability	0092-14-06

Principal Investigator Name	Project Oversight Committee Chair Name	Project Start Date (m/d/yyyy)
Ramon Bonaquist	Carl Johnson	9/18/2013
(Area Code) Telephone Number	**(Area Code) Telephone Number**	**Original End Date (m/d/yyyy)**
703-444-4200	414-466-0644	6/17/2015
Email Address	**Email Address**	**Current End Date** (m/d/yyyy)
aatt@erols.com	carlj@starkasphalt.com	9/17/2015

Project Schedule Status *(check one)*
☐ On Schedule ☒ On Revised Schedule ☐ Ahead of Schedule ☐ Behind Schedule

Project Budget Status

Total Project Budget	Expenditures Current Quarter	Total Expenditures	% Funds Expended	% Work Completed
$224,992.00	$28,863.74	$60,281.48	26%	26%

Project Description

The objective of this project is to develop recommended revisions to WisDOT specifications and guidance documents to improve the durability of asphalt concrete mixtures. The project will focus on changes to the composition of asphalt mixtures that WisDOT should consider to improve durability. The recommendations will be based on promising findings from completed research addressing asphalt concrete durability and the results of a laboratory study formulated specifically to evaluate the effectiveness of these promising findings for Wisconsin materials and environmental conditions. The project includes six tasks:

1. **Synthesis of Current Research.** Research on the durability of asphalt mixtures completed since NCHRP Projects 9-25 and 9-31 will be reviewed to identify recommendations for improving mixture durability.
2. **Work Plan Development.** Appropriate laboratory experiments will be designed based on the findings of Task 1.
3. **Interim Presentation and Project Memorandum.** The findings of Task 1 and the work plan developed in Task 2 will be presented to the Project Oversight Committee (POC).
4. **Execution of Work Plan and Analysis of Results.** The experiments in the work plan approved by the POC will conducted and the results analyzed.
5. **Project Deliverables.** A report documenting the project and making recommendations concerning changes to WisDOT specifications to improve durability will be prepared.
6. **Final Report and Project Closeout Activities.** The report and recommendations will be presented to the TOC and the report will be revised based on comments from the TOC.

Progress This Quarter *(includes meetings, work plan status, contract status, significant progress, etc.)*

Task 1. Synthesis of Current Research. This task was completed during the first quarter of 2014. The findings are documented in the Interim Report submitted in Task 3.

Task 2. Work Plan Development. This task was completed during the first quarter of 2014. The proposed experiment is documented in the Interim Report submitted in Task 3.

Task 3. Interim Presentation and Project Memorandum. The Interim Report was submitted on April 23, 2014. The Interim Report presentation to the POC was made on July 1, 2014. The POC approved the proposed work plan and agreed to assist with identifying appropriate aggregates, mixture designs, and binders for the laboratory experiment.

Task 4. Execution of Work Plan and Analysis of Results. Dr. Bonaquist participated in a conference call on November 7, 2014 to discuss the use of the intermediate temperature semi-circular bend (SCB) test in the project. Two important items were discussed: (1) test temperature, and (2) between laboratory variability. Based on testing completed by Mathy for their high recycle project, a temperature of 15 °C appears to be appropriate for Wisconsin conditions. The between laboratory variability observed in the high recycle projects appears to be associated with differences in the equipment used to conduct the test. Results from tests conducted in general purpose servo-hydraulic loading equipment differed from those obtained from the Disk-Shaped Compact Tension Test equipment that has been modified to perform the SCB test. The data from the general purpose servo-hydraulic loading equipment appear to be more reasonable, having load displacement curves similar to those reported by the developers of the test at the Louisiana Transportation Research Center. Based on this conference call, SCB tests for this project will be conducted at 15 °C using an SCB fixture in a general purpose servo-hydraulic load frame.

The project was modified to replicate the approved experiment using two sets of materials. The amendment making this modification was issued on November 7, 2014. Tables 1 and 2 summarize the mixtures and binders to be used in the two runs of the experiment and the sources that have been identified for each of these materials. During this quarter, samples were obtained from each of the sources listed in Tables 1 and 2. Most of the materials needed for the first run of the experiment are in the laboratory with the exception of the 19.0 and 9.5 mm virgin mixtures. We are working with Judie Ryan to identify sources for these mixtures and the run 2 materials.

Table 1. Required Representative Mixtures.

Nominal Maximum Aggregate Size, mm	Recycle Content	Run 1 Supplier	Run 2 Supplier
19.0	Virgin		
12.5	Virgin	Stark Asphalt	
9.5	Virgin		
19.0	RAP	Mathy	
12.5	RAP	Mathy	
9.5	RAP	Stark Asphalt	
19.0	RAP+RAS	Payne and Dolan	Rock Roads
12.5	RAP+RAS	Mathy	Rock Roads
9.5	RAP+RAS	Payne and Dolan	

Table 2. Required Representative Binders.

Binder	Run 1 Supplier	Run 2 Supplier
PG 64-22, Grade S	Payne and Dolan	
PG 64-22, Grade H	Stark Asphalt	
PG 64-22, Grade V	Stark Asphalt	
PG 58-28, Grade S	Payne and Dolan	
PG 58-28, Grade H	Payne and Dolan	
PG 58-28, Grade V	Payne and Dolan	
PG 58-34, Grade S	Payne and Dolan	
PG 58-34, Grade H	Payne and Dolan	
PG 58-34, Grade V	Payne and Dolan	

The primary mixture used in the Box-Behnken experimental design is the 12.5 mm RAP mixture. This mixture is used in 7 of the 27 cells of the experiment. The aggregate for this mixture for run 1 was processed and we are ready to begin fabricating specimens upon receipt of the SCB fixture in early January.

Binder characterization testing was completed on 6 of the 9 run 1 binders listed in Table 2. Recovered binder characterization was completed on the 6 run 1 recycled materials (RAP and RAS) listed in Table 1.

Ta**sk 5. Project Deliverables.** The Interim Report for Tasks 1 and 2 will be included in the final report for the project. No additional work on project deliverables was completed.

Task 6. Final Report and Project Closeout Activities. No work has been performed on this task.

Anticipated Work Next Quarter

Task 1. Synthesis of Current Research. This task has been completed.

Task 2. Work Plan Development. This task has been completed.

Task 3. Interim Presentation and Project Memorandum. This task has been completed.

Task 4. Execution of Work Plan and Analysis of Results. Laboratory testing will continue using the available run 1 materials. Appropriate mixes for the virgin 19.0 and 9.5 mm mixture will be identified and sampled weather permitting. Materials for run 2 will be identified and sampled weather permitting. It is anticipated that run 1 will be completed next quarter and the materials for run 2 will be indentified and sampled.

Task 5. Project Deliverables. The laboratory testing and analysis will be documented as work proceeds.

Task 6. Final Report and Project Closeout Activities. No work is planned for this task.

Circumstances Affecting Project or Budget

The project schedule was revised to accommodate the additional testing included in the amendment.

Attach / Insert Gantt Chart and Other Project Documentation

Task/Activity	2013			2014												2015								
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Task 1. Synthesis of Current Research.	P	P	P																					
	A	A	A	A	A	A	C																	
Task 2. Work Plan Development.		P	P																					
			A	A	A	A	C																	
Task 3. Interim Presentation and Project Memorandum.				P																				
				A	A	A	A	A	A	C														
Task 4. Execution of Work Plan and Analysis of Results.					P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P			
										A	A	A	A	A	A									
Task 5. Project Deliverables.															P	P	P	P	P	P	P			
Task 6. Final Report and Project Closeout Activities.																			P	P	P	P	P	P
Presentations				P																				
Quarterly Reports				P			P			P			P			P			P			P		
				C			C			C			C			C								
Project Memorandum				P				C																
Draft Final Report																			P			P		
Revised Final Report																					P			P

*(*enter text)*

For WisDOT Use Only	
Staff Receiving QPR J. Walejko	Date Received (m/d/yyyy) 1/7/2015
Staff Approving QPR Carl Johnson	Date Approved (m/d/yyyy) 2/10/2015